

Provider Economics Model Guidance



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For Recipient's Use	

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1. Introduction

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Introduction

Purpose:

This guidance accompanies the **Provider Economics Model** (“the model”) and should be read in full prior to using the model. It sets out how to use the model, interpret the results and also make changes to the assumptions. Ideally, the model should be considered in parallel with the **Provider Sustainability Framework** which looks at questions that should be considered when trying to understand the impact of a commissioning decision on a provider’s economics.

The model has been designed to be easily accessed by new users, with results and analysis that is easily generated and reviewed. This is done by producing analysis based on a simple commissioning decisions, based on data for a selected provider. Further input of a user’s own/local data can also produce more tailored analysis.

The principle purpose of the model is to help providers, commissioners and other interested parties understand the possible impact of potential commissioning changes on their provider’s costs and quality and to provide a basis for discussion. The model does not make value judgements and is not a decision making tool. Any decision based on the output from this model should be in conjunction with other supporting material.

The model can be used to consider changes for acute, mental health and community service providers, although the analysis is strongest for acute providers due to the quality of data that has been available.

The box opposite summarises the broad areas of output provided by the model.

Scope of model

Understanding the effect of a commissioning change on the provider at the service line level, in particular:

- the possible impact of changes on unit and total cost by service line;
- understanding possible clinical dependencies between service lines;
- indicative benchmarking of costs for service lines to help identify areas for potential efficiency savings;
- understanding possible minimum levels of activity for certain interventions within a service line; and
- information on how the commissioning change affects the activity of the provider in terms of the distribution of all providers of a given service line.

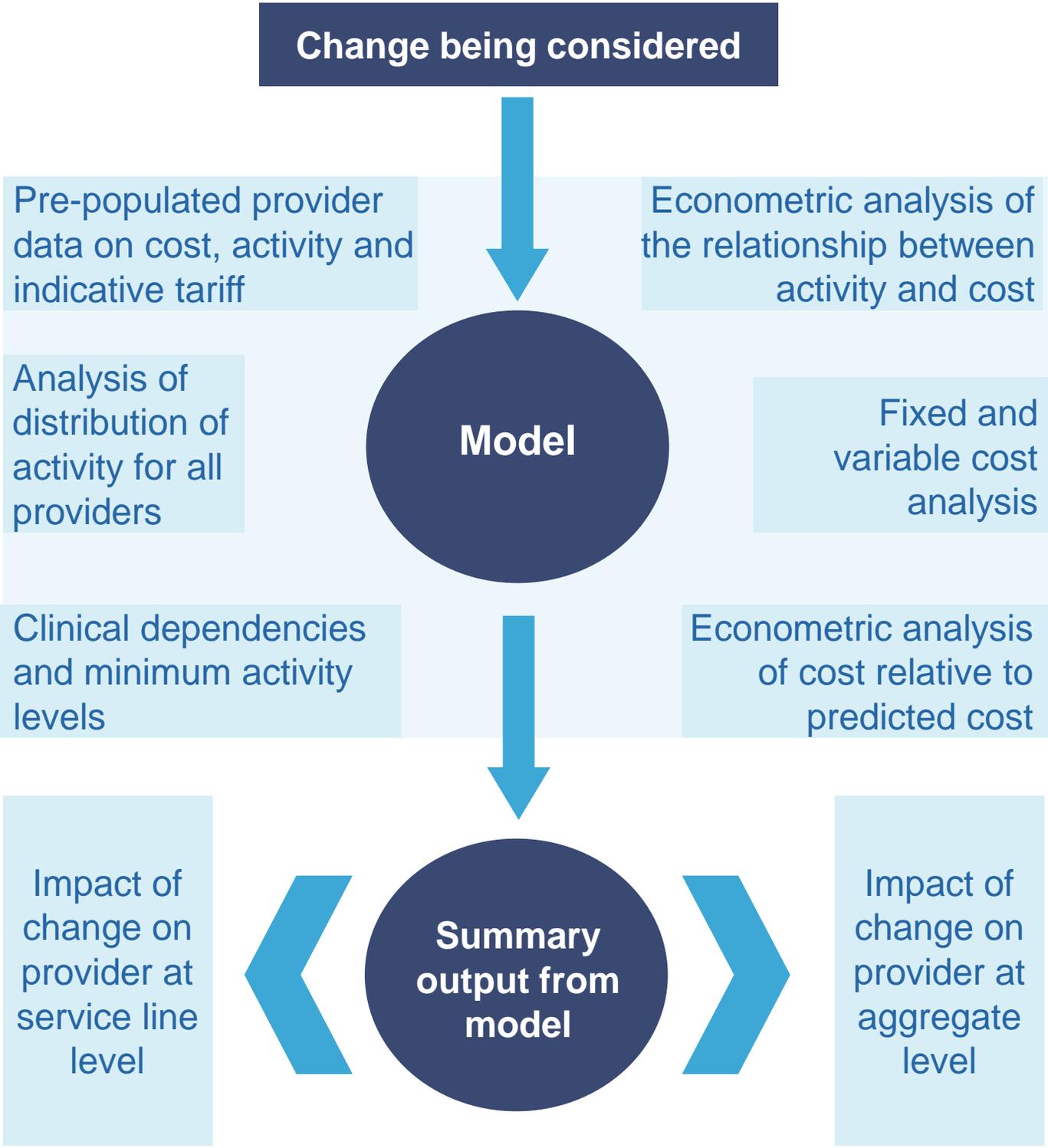
Understanding the effect of a commissioning change on a provider, in particular:

- the overall impact on unit and total cost of multiple changes; and
- potential impact of multiple changes on the provider’s income.

Furthermore, whilst recognising there are local differences, the model provides:

- the mapping of HRGs to service lines that use in the analysis; and
- a potential mapping of service lines for mental health and community services to pathways and care clusters.

Provider Economics Model Overview



Provider Economics Model Sheets Description - 1

The Provider Economics Model is a spreadsheet-based tool. The spreadsheet has multiple sheets where users input data and assumptions and view the results. Other sheets contain the calculations that sit behind the model. The following tables summarise the content of each of the sheets in the spreadsheet model.

Model sheet		Description, functionality and remarks
Welcome	Intro	Welcome and disclaimers
0 - Index		Index sheet for model
1 - Provider select	Input selection	Select provider for analysis – Users can select an exiting organisation or add a new organisation choosing sheet <<Add new provider>>
2 - Activity change		Set percentage change in activity by Service Line.
3 - Calculate		Buttons to initiate calculations of the changed activity.
4 - Detailed service line summary	Output summary	Detailed analysis of provider for selected Service Line.
5 - Detailed provider summary		Detailed analysis of provider.
6 - Service line overview-numerical		Numerical summary of provider financials for all Service Lines.
7 - Service line overview-figures		Graphical summary of current and predicted unit cost following commissioning change.
8 - Add own income and cost data	Input and change Model drivers	Sheet to enter local activity, unit cost and unit income data at the Service Line level.
9 - Fixed & variable costs		Input user data on costs for split by fixed- and variable- costs.
10 - Econometric value		User can select base estimates or select other values for the coefficients.
11 - HRG level change		Sheet allows user to specify activity change at the HRG level,

Provider Economics Model Sheets Description - 2

Model sheet		Description, functionality and remarks
12 - Service line map	Underlying analysis	Mapping of HRGs onto Service Lines
13 - CS Pathways		Community services Service Line to pathway map.
14 - MH Care clusters		Mental health Service Lines to care clusters.
15 - Fixed & variable cost analysis		This sheet contains fixed, variable and semi-fixed costs by Service Lines from the underlying analysis.
16 - Econometric analysis		The sheet contains a summary of the econometric analysis used in the model including the “activity elasticities of unit cost” and information relating to the usability of the econometric analysis.
17 - Unit cost relative to predicted		The sheet contains a summary of whether a provider’s unit cost for a Service Line is above what the econometrics predicts for an equivalent provider (i.e. a benchmark)..
18 - Distribution analysis		The sheet contains a summary of the distribution of activity for providers based on the 2008/09 reference cost data.
19 - Dependencies		The sheet contains an initial overview of the Service Lines that are likely to have clinical dependencies on the Service Line being considered.
20 - Minimum activity levels		The sheet contains an initial overview of some clinical minimum activity levels by intervention, which are allocated to Service Lines.
21 - A-HRG calculations		Working sheets Should not be used.
22 - B-Service line calculations	Calculations at the Service Line level.	
23 - Provider data	Underlying provider data on activity, cost and tariff.	

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Using the model

Quick start - choice and running model

1. *Select provider for analysis*

The model contains pre-populated data for over 400 different providers. These data include:

- 2008/09 reference cost data including cost and activity at the HRG level;⁽¹⁾ and
- estimated tariff income at HRG level for each provider.⁽²⁾

To select a particular provider:

- select **<<1-Provider select>>** sheet;
- use the drop down menu to select provider from list; and
- this sets the pre-populated provider data to be used in the analysis.

If you want to enter or change the data contained in the model for your provider, the process for this is detailed on page 10.

2. *Set commissioning decision*

To get a quick and indicative estimate of the effect of a commissioning change, the model allows the user to specify activity changes at the Service Line level. This can be done by:

- select **<<2-Activity change>>** sheet;
- use the slide bars to set the % change in the activity level of a Service Line;
- this sets the initial change in activity (+/-) in percent for the particular Service Line; and
- changes can be made to multiple service lines, if required.

The following sheet details how to make more detailed commissioning decisions at the HRG level.

3. *Calculate*

To run the model for the selected provider and commissioning decision:

- select **<<3-Calculate>>** sheet; and
- press the **“Run default analysis”** button to initiate the model.⁽³⁾

The model should take no longer than a couple of minutes to run.

Notes: (1) Activity in the reference cost data is FCE and not spell, consequently the model applies an adjustment of 1.14 FCEs to 1 spell (this assumption can be adjusted).

(2) Tariff income is based on national tariff for 2009/10 and does not include any adjustments for factors, such as MFF. Additionally, total tariff income is calculated based on the adjusted activity variable detailed in footnote (1) above and is therefore an estimate.

(3) It is important to make sure that the Excel option to allow macros to be run is turned on.

Using the model

1. Adding or changing your provider's data and FCE to spell adjustment factor

1. To add to or edit data for your selected provider:

- after selecting the provider, press the “**Pre-populate data**” button on the <<3-Calculate>> sheet – this will pre-populate the model with the data for the selected provider;
- ensure that the “**Locally entered data**” option in cell **G27** is selected;
- select the <<Add own income and cost data>> sheet and make the desired changes to the data – it is important to maintain the structure of the data that should be present on the sheet; and
- finally run the model with the updated data by pressing the “**Run tailored analysis**” button on the <<3-Calculate>> sheet.

It is important to note that the “current relative to predicted unit cost summary” output on the <<Detailed service line summary>> from the model will remain based on the original data and not the updated data.

2. Change FCE to spell adjustment factor

The reference cost data used to operate the model is FCE based. The model therefore applies an adjustment to adjust FCEs into spells for the purpose of calculating tariff income. The default adjustment is 1.14 FCEs to 1 spell.

To adjust the factor:

- move the **slider** under step 0 on the <<3-Calculate>> sheet ;

Then run the tailored version of the model as follows:

- press the “**Pre-populate data**” button on the <<3-Calculate>> sheet; and
- finally run the model with the updated data by pressing the “**Run tailored analysis**” button on the <<3-Calculate>> sheet.

Using the model

2. Changing fixed- and variable- costs and choosing how to treat semi-fixed costs

The model allows users to edit the fixed cost values used in the model either through entering own local cost data, by entering the percentages of fixed and variable costs directly, or by changing the assumption relating to the treatment of semi-fixed costs (by default these are assumed variable).

To make any of these changes:

- after selecting the provider, press the “**Pre-populate data**” button on the **<<3-Calculate>>** sheet to pre-populate the model;
- for **locally entered data**, the option in cell **G28** should be selected and changes should then be made in the **<<Fixed & variable costs>>** sheet as follows:
 - to calculate fixed and variable costs based on locally entered cost data, enter values in **columns D to R** and then press the “**Calculate new cost split based on user data**” button at the top of the sheet; or
 - enter values for the percentage of fixed and variables costs directly in **columns S and T**; or
 - to re-enter the base data press the “**Refresh with pre-populated data**” button.
- to change the **treatment of semi-fixed costs**, the option in **G29** should be selected on **<<3-Calculate>>** sheet;
- finally, to run the model based on the updates, press the “**Run tailored analysis**” button on the **<<3-Calculate>>** sheet.

Using the model

3. Changing the econometric coefficients

Column H on the sheet <<**Econometric value**>> presents the econometric coefficients used in the model. Although generally not recommended, these values can be changed by the user as follows:

- after selecting the provider, press the “**Pre-populate data**” button on the <<**3-Calculate**>> sheet to pre-populate the model; then
- ensure that the “**User selected/entered values**” option under “**Econometric analysis**” in cell **G30** is selected on the <<**3-Calculate**>> sheet;
- select the <<**Econometric value**>> sheet and either:
 - press the “**Set higher bounds for all Service Lines**” button or “**Set lower bounds for all Service Lines**” button to use values based on either the upper or lower 95% confidence interval calculated by the econometric models; or
 - enter own value into the relevant cell in **column H** (values outside the 95% confidence interval will result in the cell turning red as these are not supported by the econometric modelling); or
 - reset the original econometric value (the “point estimates”) by pressing “**Reset point estimates for all Service Lines**” button;
- run the model with the updated data by pressing the “**Run tailored analysis**” button on the <<**3-Calculate**>> sheet.

Using the model

4. HRG level activity change

The sheet <<HRG level change>> allows the user to make activity changes at the HRG, as opposed to Service Line, level. This allows more granular commissioning decisions to be simulated.

To do this:

- after selecting the provider, press the “**Pre-populate data**” button on the <<3-Calculate>> sheet to pre-populate the model;
- ensure that the “**Set adjustments at the HRG level**” option under “**Activity change level**” (i.e. in cell **G31**) is selected on the <<3-Calculate>> sheet;
- select the <<HRG level change>> sheet and either:
 - press “**Set values based on <<2-Activity change>> sheet**” button to use the values set by Service Line in the <<2-Activity change>> sheet; or
 - enter values between -100% or +100% in **column F**; or
 - press to reset all values to 0% press the “**Set all values to 0%**” button.
- run the model with the updated data by pressing the “**Run tailored analysis**” button on the <<3-Calculate>> sheet.

Using the model

Being aware of the strengths and limitations

The model is a tool to provide input into decisions and not a decision making tool in itself. It will help to facilitate a mature and evidence based discussion between commissioners and providers as they consider changes within a local health community. To use the model effectively, you should be aware of both its strengths and limitations.

- The econometric analysis underlying the model is much stronger for acute providers than community and mental health providers due to data quality and availability. Consequently, community and mental health providers are likely to benefit most from the “fixed and variable cost analysis” rather than the econometric analysis.
- Econometric analysis is a powerful tool and represents a significant step in understanding the relationship between cost and activity, but should be treated with adequate caution. The econometric results are less likely to be representative for large changes in activity at the ends of the activity distribution. This is flagged in the model.
- In the “Behind the Model” section of this guidance there are details of the econometric analysis and the variables used. Users relying on the results driven by the econometrics should also refer to main Provider Economics report that accompanies this guidance.
- Users should ensure that the data underlying the model is reasonably representative for their provider. While care has been taken to ensure this, poor data may be an issue for some providers. This is particularly the case for community and mental health providers.
- Tariff data is based on 2009/10 mandatory rates and is not adjusted for elements, such as the Market Forces Factor.
- Activity is from 2008/09 reference cost data and is for FCEs and not spells. An adjustment of 1.14FCE to 1 spell is applied in the model to attempt to correct this, but the adjustment is basic and may cause a provider’s data to be unrepresentative in the model. If this is the case, adjustments can be made to a provider’s data in the model – see page 10.

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Output

Introduction

The model provides output in four sheets:

- <<Detailed service line summary>>
- <<Detailed provider summary>>
- <<Service line overview-numerical>>
- <<Service line overview-figures>>

1. <<Detailed service line summary>>

This sheet summarises output for the commissioning change for the provider for a service line in two broad categories:

- issues that should be considered from the perspective of maintaining quality; and
- potential impact on cost and finances.

2. <<Detailed provider summary>>

This sheet presents output from the model for the commissioning change for the provider in terms of the impact on activity, cost and income.

3. <<Service line overview-numerical>>

This sheet presents a numerical overview of all changes for all service lines on the selected provider's activity, cost and indicative tariff income.

4. <<Service line overview-figures>>

This sheet is a graphical summary of impact of change on unit and total costs for the selected provider.

The following slides have further details of the content of each of these sheets.

Output

1. Detailed service line summary – potential impact on quality

<<Detailed service line summary>>

The potential impact of the change on quality is summarised in the top half of the sheet. There are five pieces of information:

(1) Dependencies: what other service lines may be impacted by a change to the selected Service Line? Based on clinical relationships that may exist between Service Lines. These should be seen as either a starting point for a fuller analysis or a reminder of the importance of these dependencies.

(2) Actual unit cost relative to predicted unit cost: how does the provider's activity weighted unit cost compare to the predicted value based on the econometric model? Being significantly above or below the predicted value will raise a flag ("Higher than expected" or "Lower than expected"), which might be an indication of potential efficiencies or inefficiencies for the provider. However, this output should be understood in the context of the limitations of the econometric modelling.

Possible quality implications of decision

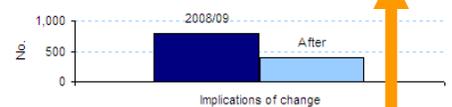
Possible dependent service lines that may be affected	Consider at least the following service lines
Dependencies	Adult Critical Care, Emergency and Urgent Care, Trauma and Orthopaedics

Information on minimum activity level	Consider at least the following areas within service line
Minimum activity levels	Amputation of lower limb (>11 treatments per year per hospital), Cholecystectomy (>109 cases per year per hospital), Cholecystectomy (>168 cases per year per hospital), Oesophageal Cancer (>3 operations per surgeon per year), Pancreatic Cancer (>46 cases per surgeon per year)

Implications of change	Activity (No.)	% of total
2008/09	797	0.03%
After	399	0.03%
Change	-399	-50.00%

	Value (€s)
Current unit cost	3,973
Current relative to predicted unit cost	Higher than expected

Percentile	Activity (No.)
10th	280
25th	479
Median	698
75th	1,081
90th	1,467



(3) Change in activity: what is the impact of the change on the level of activity for the provider for the selected Service Line? The absolute value of activity is presented with the percentage that this forms of the provider's total activity. For the change in activity, the percentage is the difference between the before and after activity level for the Service Line.

(4) Minimum activity: what is the clinically safe level of activity for interventions under the selected Service Line? For example, "fewer than 11 lower limb amputations per year per hospital" may raise clinical safety concerns. As for the dependencies, this is not an extensive summary and should be used as either a starting point or a reminder of the importance of this consideration.

(5) Activity distribution: information on the distribution of activity of the Service Line for all providers in the dataset.

Output

1. Detailed service line summary – potential impact on finances

<<Detailed service line summary>>

The potential impact of the change on cost and finances is summarised in the bottom half of the <<Detailed service line summary>> sheet. Broadly there are four pieces of information:

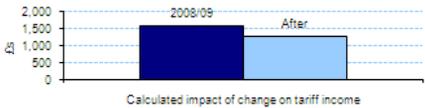
(1) Relationship between activity and cost: summary of the findings from econometric and fixed and variable cost analysis (blue shaded cells) and the values used to operate the model (un-shaded cells).

(2) Impact of change on indicative tariff income: what is the impact of the activity change on estimated tariff income and how does this relate to total indicative tariff income for the provider? The absolute value of activity is presented with the percentage that this forms of the provider's total. For the calculated change, the percentage is the difference between the before and after for the Service Line.

Cost and general financial implications

Information on cost structure from modelling	Unit of measurement	Value used in calculations	Central estimate	Notes:
<i>Econometrics analysis</i>	% change in unit cost as a result of a 10% decrease in activity	2.60%	2.60%	Possible range: 1.34% to 3.86%
<i>Fixed and variable cost analysis</i>	Proportion of fixed costs	20%	20%	Possible non-linearities not captured in model Semi-fixed costs treated as variable

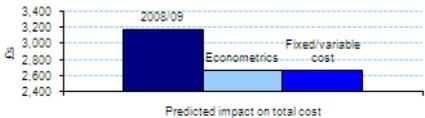
Calculated impact of change on tariff income		Value (£s)	% of total
2008/09		1,574,956	0.68%
After		1,259,965	0.55%
Change		-314,991	-20%



Predicted impact of change on unit cost		Value (£)	% of total
2008/09		3,973	-
Econometric analysis	After	4,179	-
	Change	206	5%
Fixed and variable cost analysis	After	4,170	-
	Change	197	5%



Predicted impact on total cost		Value (£s)	% of total
2008/09		3,166,384	0.58%
Econometric analysis	After	2,664,722	0.49%
	Change	-501,661	-16%
Fixed and variable cost analysis	After	2,658,972	0.49%
	Change	-507,411	-16%



(3) Predicted impact of change on unit cost: pre-change activity weighted unit cost for the service line and the predicted impact of the commissioning change on the unit cost, based on the econometric analysis and also the fixed and variable cost analysis. Percentage of total summarises the actual change in unit cost relative to the original value.

(4) Predicted impact of the change on total cost: what is predicted impact of the change on total cost for the selected Service Line for the provider based on the econometric and fixed and variable cost analysis?

Output

2. Detailed provider summary

<<Detailed provider summary>>

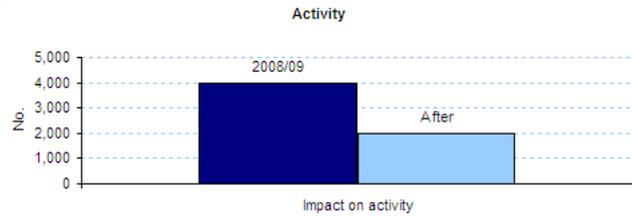
This sheet presents output from the model for the change for the provider in terms of the impact on activity, cost and tariff income.

(1) Modifications to provider income and costs: the model allows the user to scale up (or down) tariff income (e.g. for **MFF adjustment**) in cells G11 and H11, and also add (or subtract) lump sums from total tariff income (e.g. to reflect **block contracts**) in cells G12 and H12. Similar adjustments can also be made to provider costs (e.g. to reflect the **cost of transition**) in cells G16, H16 G17 and H17.

(2) Summary of change: short summary of the impact of the change, following the user adjustments in (1), on activity, income and cost.

Selection					
Provider:	GUY'S AND ST THOMAS' HOSPITAL FOUNDATION TRUST				
Adjustments to income		Value (£)			
		2008/09	Post		
Lump sum addition to income (e.g. for block contract payment)		1,000,000	1,000,000		
Scale adjustment to tariff (e.g. for MFF)		2	2		
Adjustments to cost		Value (£)			
		2008/09	Post		
Lump sum addition to cost (e.g. for cost of transition)		0	10,000		
Scale adjustment to cost (e.g. to reflect a cost uplift not captured)		1	1		
Adjusted provider values	2008/09	After		Change	
		Econometric analysis	Fixed and variable cost analysis	Econometric analysis	Fixed and variable cost analysis
Activity	3,968,998	1,984,499	1,984,499	-1,984,499	-1,984,499
Income (£)	555,041,716	278,020,858	278,020,858	-277,020,858	-277,020,858
Cost (£)	684,992,963	373,143,961	613,234,136	-71,758,827	-311,849,002

Print sheet



(3) Graphical summary of change: three graphs summarising the collective impact of all changes to all Service Lines for the provider.

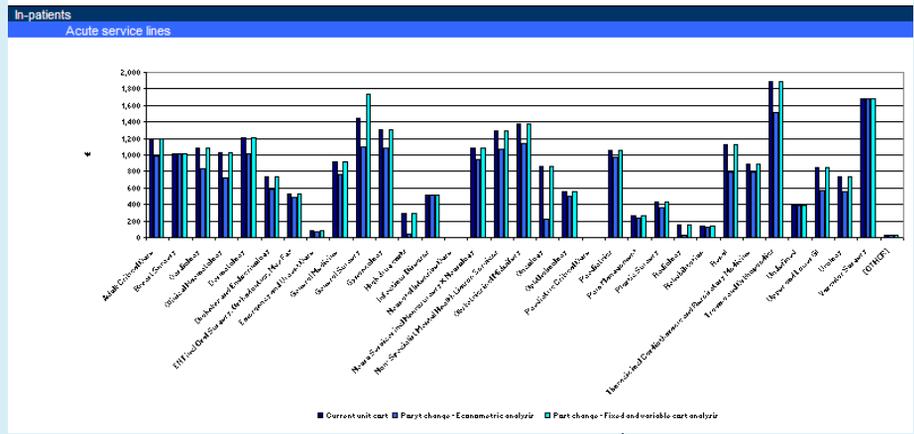
Output

3. & 4. Service line overview -numerical and -figures

<<Service line overview-numerical>>
<<Service line overview-figures>>

These two sheets present a summary of the impact of the change for a provider for all of the Service Lines in the model. The “numerical” sheet can be used to run other analysis (i.e. outside of the main model), while the “figures “ sheet provides a quick summary of all the changes on total and unit cost.

Example of the “Figures” summary



Example of the “Numerical” summary

Provider: *** New Provider ***			Cost structure			Predicted impact of change on unit cost					Calculated impact of change on tariff income		
Patient type	Service grouping	Service line	Fixed and variable cost analysis	Econometrics analysis	Change in activity	Current	Post change as predicted by FCVC	Change	Post change as predicted by econometrics	Change	Current tariff income	Post change tariff income	Change
In	Acute	Dermatology	28.7%	-16.0%	0.0%	1208	1208	0.00	1015	-192.63	2,537,643	2,537,643	0.00
In	Acute	Diabetes and Endocrinology	32.4%	-20.6%	0.0%	734	734	0.00	582	-151.14	1,797,732	1,797,732	0.00
In	Acute	ENT incl Oral Surgery, Orthodontics, Max/Fac	21.8%	-7.0%	0.0%	524	524	0.00	487	-36.67	886,826	886,826	0.00
In	Acute	Emergency and Urgent Care	19.7%	-13.5%	0.0%	86	86	0.00	74	-11.59	5,079,840	5,079,840	0.00
In	Acute	General Medicine	19.1%	-15.6%	0.0%	911	911	0.00	769	-142.04	162,295	162,295	0.00
In	Acute	General Surgery	19.9%	-23.7%	-50.0%	1445	1732	287.20	1102	-342.85	1,967,296	983,646	-983,646.00
In	Acute	Gynaecology	21.5%	-17.1%	0.0%	1312	1312	0.00	1088	-224.27	2,272,925	2,272,925	0.00
In	Acute	High drug costs		-87.5%	0.0%	290	290	0.00	36	-254.00	0	0	0.00
In	Acute	Infectious Diseases	19.0%		0.0%	521	521	0.00	521	0.00	7,639,777	7,639,777	0.00
In	Acute	Neonatal Intensive Care		-10.8%	0.0%			0.00	0	0.00	0	0	0.00
In	Acute	Neuro Services incl Neurosurgery & Neurology	18.7%	-13.2%	0.0%	1089	1089	0.00	945	-143.56	10,215,378	10,215,378	0.00
In	Acute	Non- Specialist Mental Health Liaison Services		-17.4%	0.0%	1287	1287	0.00	1063	-223.95	0	0	0.00
In	Acute	Obstetrics incl Midwifery	21.0%	-17.0%	0.0%	1377	1377	0.00	1143	-233.98	1,450	1,450	0.00
In	Acute	Oncology	21.4%	-74.0%	0.0%	861	861	0.00	224	-637.25	0	0	0.00
In	Acute	Ophthalmology	25.6%	-9.5%	0.0%	959	959	0.00	906	-53.25	14,408,221	14,408,221	0.00
In	Acute	Paediatric Critical Care	37.8%		0.0%			0.00	0	0.00	0	0	0.00

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Example

Background and questions to consider

- **Scenario**

- You are the lead commissioner for respiratory services for “**Hartsfield PCT**”.
- You have been tasked to review the provision of “**Chronic Obstructive Pulmonary Disease**” (COPD) services within your health economy.
- In particular, you are considering the impact of decommissioning **25%** of Chronic Obstructive Pulmonary Disease (COPD) services from “**Hartsfield Foundation Trust**”.

- **Background**

- Chronic Obstructive Pulmonary Disease (COPD) falls under the Service Line “**Thoracic, Cardiothoracic and Respiratory Medicine**” (“TCRM”)
- A drop of **25%** in COPD is equivalent to a drop of about **4%** in the Service Line TCRM for “**Hartsfield Foundation Trust**”

- **Questions to consider**

1. What is the potential cost and revenue impact of a 4% reduction in Thoracic, Cardiothoracic and Respiratory Medicine activity?
2. What other service lines may be affected and does the model suggest any other clinical concerns?
3. What if activity was reduced by 80%?
4. How do your answers to 1-3 change if you consider reducing only the HRGs relating to COPD (i.e. a 25% reduction in all COPD HRG groups)?

Example

Using the model with the example - 1

1. What is the potential cost and revenue impact of a 4% reduction in Thoracic, Cardiothoracic and Respiratory Medicine activity?

- Open the model and ensure that macros have been enabled.
- Select the **<<1-Provider select>>** sheet and select “**Hartsfield Foundation Trust**” from the drop down list (NB: this is a hypothetical provider).
- Move to the **<<2-Activity change >>** sheet and adjust the inpatient TCRM (**line 38**) Service Line to show -4%.
- Move to **<<3-Calculate >>** sheet and press the “**Run default analysis**” button.
- When calculations have finished, the model will move you to the **<<Detailed service line summary>>** sheet .
- Select “**In - Thoracic incl Cardiothoracic and Respiratory Medicine**” from the drop down menu to display the output from the model for this Service Line.
- Note the following points:
 - fixed cost proportion of **21%** (**cell D35**);
 - the econometric coefficient is **1%** (**cell D34**) may be in the range **0.5%** to **1.7%** (**cell E34**), but there are non-linearities that may not be captured by the model (**cell F34**);
 - moderate impact on tariff (**cell H34**);
 - the change in unit cost using fixed cost analysis (**cell D48**) is about double the change using the econometric analysis (**cell D46**), which may reflect the difference between short (fixed and variable) and long run (econometric) adjustment of costs; and
 - overall costs are greater than estimated tariff income and the impact on total costs of the commissioning change is about £500,000 under both approaches (**cell D53 and D55**).

2. What other service lines may be affected and does the model suggest any other clinical concerns?

- Dependencies: **cell C13** suggests the following Service Lines may be affected:
 - Cardiology;
 - Trauma and Orthopaedics; and
 - Vascular Surgery.
- Activity levels: no minimum levels flagged (**cell C18**), although this does not mean that none exist; and
- Hartsfield FT appears to fall between the **median** and **75th** percentile of the activity distribution for this Service Line and not at the extremes before or after the change (see **cell D25 and D26** vs. **cells I18 to I22**).

Example

Using the model with the example - 2

3. What if activity was reduced by 80%?

- Return to the <<2-Activity change >> sheet and adjust the slider for TCRM to **-80%** (line 38).
- Move to <<3-Calculate >> and press the “Run default analysis” button.
- Note the following changes:
 - activity moves towards the tail of the distribution (below the 25th percentile) for the Service Line (cell D26 vs. I19 and I18);
 - a flag is raised regarding the usability of the econometrics for this change in activity (cell H34);
 - under the econometric analysis, unadjusted tariff is still smaller than total costs (cell D39 vs. D53)
 - under the fixed and variable cost analysis, unadjusted tariff is considerably less than total costs, (cell D39 vs. D55)

4. How do your answers to 1-3 change if you consider reducing only the HRGs relating to COPD? (i.e. a 25% reduction in all COPD HRG groups?)

- Return to << 2-Activity change>> and move the slider for TCRM back to **0** or press the “Reset” button at the top.
- Move to <<3-Calculate >> and press the “Pre-populate data” button.
- Select the “Set adjustments at the HRG level” option under “Activity change level” (the box in cell G31 should be ticked).
- Move to the sheet titled <<HRG level change>> and search for the COPD HRG codes (“DZ21” codes) and set values for these in column L to **-25%**.
- Return to << 3-Calculate>> and press “Run tailored analysis”.
- Note the following changes:
 - change in activity from the change represents a change of **-3.5%** at the Service Line level (cell E27);
 - no flag is raised regarding the usability of the econometric results for the activity change considered (cell H34); and

1. Introduction
2. Using the model
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4. Example
5. Behind the model

Behind the model

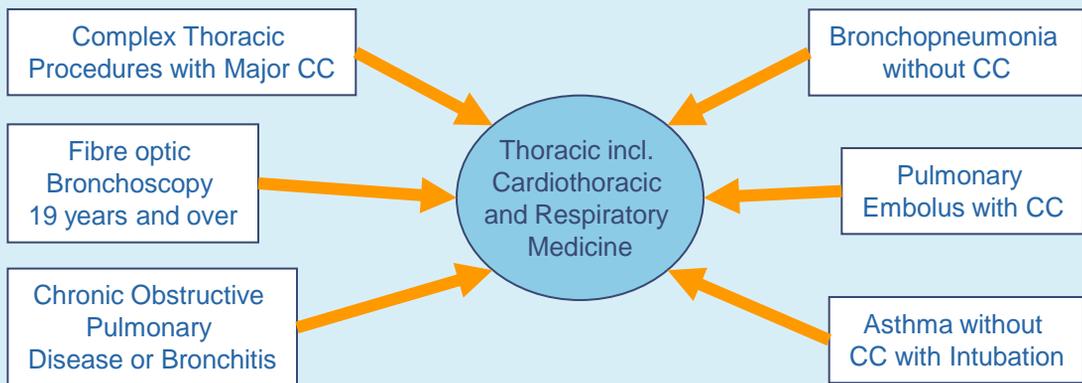
Service lines

The model is built-up using HRG-level data but most of the analysis is undertaken at the service line level. This was partly because data quality, and in particular the reference cost data, is more likely to be reliable when aggregated to service lines, and also service lines are closer to the units that commissioners use when making commissioning decisions. The additional benefits of using services include the following: they were needed to facilitate the econometric and fixed and variable costs analyses, they improve the exposition and usability of results.

HRGs were allocated to service lines through the following process:

- assessment by Service Line Reporting experts followed by
- assessment by Clinicians

Example of a HRG to Service Line mapping



Service line mappings have been produced for:

- acute: in- and out-patients;
- mental health: in- and out-patients; and
- community services.

A full mapping of HRGs to Service Lines is provided under the <<Service line map>> sheet in the model.

Behind the model

Pathways and care clusters

To reflect new directions in the commissioning of community services and also services in mental health, we have also considered how our service lines intersect with community service pathways and mental health care clusters.

Example of a Service Line to Pathway mapping

		Pathways		
		Promoting Health & Wellbeing & Reducing Inequalities	Services for Children and Families	Rehab & LT Neuro
Service lines	Community Drug & Alcohol Services	✓	✓	
	Family Planning & Sexual Health	✓	✓	
	Community Mental Health	✓	✓	✓

Service Lines were allocated to Pathways by clinicians based on their view of the main intersections. However, we do recognise that differences in how local services are configured will affect the mapping and therefore the current mappings should be seen as starting points for discussions as opposed to definitive mappings.

Behind the model

Clinical dependencies and minimum activity

The model includes an indicative mapping of dependencies between service lines and also some information on clinically safe minimum activity levels. These inputs were driven by clinical input, but are indicative only and should be used as either a starting point or reminder of the importance of these aspects when commissioning.

Clinical dependencies

These are dependencies that exist between certain interventions within Service Lines and result in some dependency between Service Lines. These provide a starting point and an assessment of clinical dependencies that may exist should be conducted prior to any commissioning decision.

These have only been produced for acute Service Lines. Dependencies within mental health and community services are not currently populated in the model.

Clinically safe minimum levels of activity

Where data are available, clinically safe minimum levels of activity have been included in the model for a number of service lines. These minimum activity levels are at specific intervention level, which is below the Service Line level. It is up to the user of the model and, ultimately the decision maker, to determine if these minimum levels, or any others not considered in the model, will be affected by any changes in activity.

The sources for the minimum activity levels are:

- 'Hospital volume and health care outcomes, costs and patient access' Effective Health Care, December 1996, Vol 2, Number 8, York
- 'The volume-outcome relationship in hospitals - lessons from the literature', L.Com-Ruelle, et.al Questions d'economie de la Sante, Number 135 September 2008

Behind the model

Fixed and variable cost analysis - 1

The model contains pre-populated data on the relationship between fixed and variable costs for a Service Line. Broadly, there are two types of costs that are considered in the model: fixed costs and variable costs:

- fixed costs do not change with the level of activity in the short run; but
- variable costs do change with changes in activity.

Semi-fixed costs are also considered. By default these are assumed to be variable, but this assumption can be changed within the model.

To identify the fixed, semi-fixed and variable costs used in the model, costs reported in annual accounts of 40 acute trusts and 13 mental health trusts were analysed. In addition, SLR data from two acute DGHs, six mental health trusts and two community health trusts were also examined.

Methodology

Supply costs directly correlate with patient-related activity, therefore we have grouped this under the variable costs. Staff cost are considered as a variable costs, as they vary with changes in activity albeit when there is a significant change and over a longer period of time. The remaining categories of costs are by and large fixed on an annual basis and do not correlates directly with the patient activity.

Variable costs

Cost Components	Description
Clinical Supply	This is the total revenue expenditure on supplies and services for clinical use, including payments under related maintenance contracts such as occupational and industrial therapy materials, drugs, medical gases, dressings, X-ray equipment, and blood.
Non Clinical Supply	This is total revenue expenditure on such things as cleaning equipment, materials and external contracts, provisions, staff uniforms, patient clothing, laundry, hardware and crockery, bedding and linen and contract catering.

Semi-fixed costs

Cost Components	Description
Staff Pay Costs	Staff pay costs refer to the total employment costs of the following staff groups: consultant, nursing, admin and clerical, technicians, allied health professionals, as well as agency and bank staff.

Behind the model

Fixed and variable cost analysis - 2

Fixed costs

Cost Components	Description
Executive and Non-Executive Pay Costs	The pay costs of executive and non-executive directors in respect of their services to the NHS Trust. The figure excludes redundancy and injury benefit costs but includes employer's NIC, employer's pension costs and early retirement costs, whether lump sum or otherwise.
Purchase of Services	The cost of all services provided by other NHS Trusts, other NHS bodies, Foundation Trusts and non-NHS trusts where they do not fall under one of the other operating expense headings.
Establishment	This is total revenue expenditure on administrative expenses (e.g. printing and stationery, advertising and telephones).
Transport	This is total revenue expenditure on such things as vehicle insurance, fuel, maintenance equipment, materials and external contracts.
Premises	This is total revenue expenditure such things as electricity, gas, rates and furnishings and fittings.
Clinical Negligence	This is the NHS Trust's contribution to the NHSLA.
Public Dividend Capital (PDC)	Dividends are collected on PDC from all NHS Trusts. NHS Trusts will be required to make two dividend payments per year. NHS Trusts will be required to make repayments where their year-end cash balances are forecast to exceed a maximum sum. This will be based on turnover.
Depreciation, Impairment, amortisation	This includes impairment losses due to a clear consumption of economic benefits.
Annual Audit Fees	The disclosure of audit fee.
Bad Debts	This is the sum of bad debts written off in the year and the increase or decrease in the year in the "provision for irrecoverable debts" The provision for irrecoverable debts should include 7.8% of accrued ICR income, if material. Transactions with other NHS bodies, other than Foundation Trusts should never be treated as bad debts.
Other Costs	This covers the costs which cannot be categorised under other headings. Where the total is material in relation to total "operating expenditure", the Trust is required to provide more relevant detail.

Behind the model

Econometric analysis - Overview

A central feature of the model is the underlying econometric analysis, which:

- **The estimated relationship between activity and unit cost**, expressed as a percentage change in unit cost following a percentage change in activity.
- **Unit cost relative to predicted unit cost.** The econometric models can be used to predict what unit cost would be for a provider with certain characteristics. This can be used to determine whether a provider's actual unit cost is above that predicted by the model for a hypothetical provider with the same characteristics. If actual unit cost is significantly above predicted unit cost this may be due to inefficiency, although there could be other reasons such as factors which are not adequately reflected in the model.

What is econometric analysis?:

- Econometrics is statistical analysis of data based on an understanding of the economic relationships that are believed to exist.
- It is a tool that can be used to look at specific relationships in the data after controlling for other factors. In this context we use it to identify what is the relationship between unit cost and activity after controlling for other factors including case mix.

What main pieces of data were used:

- reference cost data for 2007/08 and 2008/09;
- un-adjusted tariff data for HRG4; and
- other data on: provider estates, vacancy rates (see following table with variable list).

Behind the model

Econometric analysis – Model specification and variables

- The following cost function was considered for the modelling:

$$C = f(Y, K, Q, W, E, G)$$

- This was transformed into the Cobb-Douglas specification in log-log form for estimation

$$\ln C = \alpha + \beta \ln Y + \chi \ln K + \delta \ln Q + \phi \ln W + \varphi \ln E + \gamma G + \varepsilon$$

- Where the variables included the following:

Category	Variable	Description
C – measure of provider’s cost		
	Unit cost	Activity weighted unit cost for a provider in a given year for a given Service Line
Y - measure of a provider’s output		
	Activity ⁽¹⁾	Variable of interest, measure of economies of scale
K - measures of capital stock		
	Number of sites	Measure of capital cost
	Estate costs	Measure of capital cost
	Estate age profile	Measure of capital cost
Q - measures of a provider’s quality		
	CQC =excellent/good dummy	Dummy variable for top performing providers
	Dr Foster mortality	Indicator variable to pick quality of outcome
W - measures of input prices		
	MFF	Local prices and costs
E - efficiency and other cost function shifters		
	Activity weighted tariff	Case mix
	Proportion of elective cases	Case mix
	Bed occupancy proportion	Efficiency measure
	Total provider activity	Overall economies of scale
	Number of HRGs	Economies of scope
	Doctor and nurse vacancy rates	Reflects cost of staff
	Children specialist dummy	Specialist provider
	R&D / teaching income	Capture differences between R&D/teaching providers and other providers
G - geographic and demographic factors		
	SHA dummy variables	Geographic differences between providers
	OAP cases	Demographic
	Year = 2007/08 dummy	Changes in over time